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III. *Some Facts relative to the late Mr. John Hunter's preparation for the Croonian Lecture.* By Everard Home, Esq. F. R. S.

Read November 14, 1793.

MR. HUNTER having announced to the Royal Society that he would make the structure of the crystalline humour of the eye the subject of the CROONIAN lecture for the present year, and having, unfortunately for science, died before his observations on that subject were rendered complete, I feel it a duty I owe to his memory, as well as to the Society, to state the facts respecting this humour with which he had acquainted me; and shall subjoin an unfinished letter from Mr. HUNTER to Sir JOSEPH BANKS on the same subject.

It is now many years that Mr. HUNTER has had an idea, that the crystalline humour was enabled by its own internal actions to adjust itself, so as to adapt the eye to different distances; and when the *Tænia hydatigena* first came under his observation as a living animal, he was surprised to see the quantity of contraction that took place in a membrane devoid of muscular fibres, but made use of the fact in his investigation of the structure of the crystalline humour of the eye.

Some time after this, having occasion to dissect the eye of the cuttle-fish, which he had frequently done before, but not with exactly the same view, he discovered in the crystalline

humour a structure which corresponded with the idea he had formed of its actions in the human eye. He found it composed of laminæ, whose appearance was evidently fibrous, for some depth from the external surface ; but becoming less and less distinct, till at last this fibrous appearance was entirely lost, and the middle, or central part of the humour, was compact and transparent, without any visible laminæ. From this structure it would appear, that in the eye of the cuttle-fish the exterior parts of the humour are fibrous, the interior parts not ; so that the central part is a nucleus round which the fibrous coverings are placed. The preparations which demonstrate these facts will be laid before the Society.

As the structure of the crystalline humour in the cuttle-fish differs in nothing from that of the same humour in other animals, but in the distinctness of the fibrous appearance, Mr. HUNTER was led to consider that the exterior part in all of them was similar, although no appearance of fibres could be demonstrated.

What I have here explained, I was acquainted with at the time I had the honour of giving the CROONIAN lecture, in which I examined the different structures endowed with muscular action ; and was desirous that Mr. HUNTER would, either of himself, or through me, communicate these observations to the Society ; but this he declined doing till he had ascertained, by experiment, whether any muscular effect was really produced ; and the hope of being assisted by Mr. RAMSDEN made him, from time to time, put off making his experiments.

In the course of this season he began his experiments, which were founded upon the analogy that ought to exist between

this humour, if muscular, and others of a similar structure, which led him to expect that they would be acted upon by the same stimuli : and having found that a certain degree of heat, applied through the medium of water, will excite muscular action, after almost every other stimulus had failed, it was proposed to apply this to the crystalline humour, and ascertain its effects.

The crystalline humour taken from animals recently killed, must be considered as being still alive. Such humours were to be immersed in water of different temperatures, and placed in such a manner as to form the image of a lucid well defined object, by a proper apparatus for that purpose, so that any change of the place of that image from the stimulating effects of the warm water upon the humour would be readily ascertained. These were the experiments which Mr. HUNTER had instituted and begun ; but in which he had not made sufficient progress to enable him to draw any conclusions.

To Sir JOSEPH BANKS, from Mr. HUNTER.

Sir,

When I did myself the honour of giving in my claim to the discovery of the crystalline humour being muscular, and proposed to make it the subject of the CROONIAN lecture, I did not foresee that any thing could prevent me from fulfilling my promise ; but since that time, what with my state of health, which does not allow me to be very active ; the hurry of official business on account of the war, and my brother-in-law, Mr. HOME, being employed on the medical staff, I have not had the power of repeating my experiments, and drawing out,

to my satisfaction, the many conclusions which are the result of such a power in this humour.

The laws of optics are so well understood, and the knowledge of the eye, when considered as an optical instrument, has been rendered so perfect, that I do not consider myself capable of making any addition to it ; but still there is a power in the eye by which it can adapt itself to different distances far too extensive for the simple mechanism of the parts to effect. This power writers upon this subject have been at great pains to investigate and explain. The motion of the crystalline humour forwards and backwards, was asserted by some to be the cause ; while others supposed in the eye a power to alter its shape, so as to shorten or lengthen its axis, which altered the distance between the crystalline humour and the point of impression ; but we should consider that a part of the eye is itself a refractor, and that if its shape be altered so as to remove the crystalline humour from the point of impression, in order to enable it to bring a distant object to its proper focus on the retina, this effect will be in some degree counteracted by the anterior part of the eye refracting more than before, by being rendered more convex. But we have, in fact, no power capable of producing this effect ; for the straight muscles, so far from appearing to have this power, have been even supposed to flatten the eye, and shorten its axis : and it is very possible that the action of these muscles is such as tends to both effects ; but being in opposition to each other, the eye retains its shape, the insertion of these muscles being much more forwards than appears to be necessary for the simple motions of the eye. Further, when we consider that in many animals the shape of the eye is unalterable, as in all of the

whale tribe, the sclerotic coat being above half an inch thick, and composed of a strong tendinous substance. In many fish this coat is composed of cartilage; and in all birds the anterior part of it is (I believe) composed of bone. From all these considerations, I saw no power that could adapt the eye to the various distances of which we find it capable in the human body, unless we suppose the crystalline humour to be varied in figure, which can only be effected by a muscular action within itself. With this idea strongly impressed upon my mind, and finding that in many animals, when the crystalline humour was coagulated, it had a fibrous structure like muscles, I confess it seemed to me to confirm it; but as this might to others appear only conjecture, requiring some proof, I set about such experiments as were best adapted for that purpose. Knowing that in all violent deaths the muscles contract, I supposed the crystalline humour, if muscular, would show signs of this effect; for which purpose I got the eyes of bullocks when removed from the sockets, the moment the animal was knocked down, and while the eyes were warm the humours were removed."

Mr. HUNTER had proceeded thus far in the account of his experiments, when he was suddenly, and very unexpectedly, carried off; and as he has left no notes upon this subject, I am unable to make any addition to the account I have already given.

Mr. HUNTER's laying claim to the discovery of a fibrous structure in the crystalline humour, which had been observed long before, and described by the accurate LEUWENHOEK, may appear to require some explanation. The discovery of a fibrous

appearance in that humour, appertains to LEUWENHOEK; but the discovery of an eye in which this structure of the crystalline humour was perfectly distinct, and in which all the circumstances, of course, and situation, could be determined, is due to Mr. HUNTER : and if it should be found by future observation and experiments, that this structure, which is different from any that has hitherto been described, is capable of producing consequent actions and effects, sufficient to explain the adjustment of the eye to different distances, it will not be considered as a small, or unimportant discovery.

The melancholy event which has deprived this learned Society of so valuable a member, and which has taken from me so able an instructor, so rare an example, and so inestimable a friend, is too recent, to make any apology necessary for the shortness, or incorrectness of this account. I thought it due to the memory of my friend, that no promise of his, however inadequate I feel myself to the performance, should be left unfulfilled ; and the circumstances of distress, under which it has been drawn up, will procure for me every indulgence from this learned Society.

Leicester Square,
Nov. 4, 1793.

EVERARD HOME.

EXPLANATION OF THE PLATE, Tab. V.

Fig. 1st. A transverse section of the crystalline humour of the eye of a cuttle-fish, to shew its structure ; the central part is transparent, but the others are opaque, having been coagulated by proof spirits ; and give the appearance of distinct fibres surrounding the central part.

Fig. 1.

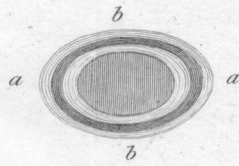


Fig. 2.



These fibres are not uniform circles or ovals, since the layers are of different thicknesses in particular parts; *aa* the fibres where they are most numerous; *bb* where they are least so.

Fig. 2d. A section of the crystalline humour, the central part being removed, to shew the fibrous structure of the surrounding laminæ.